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ENDANGERED AND THREATENED PLANT SPECIES OF SCHWAMBERGER PRESERVE, LUCAS COUNTY, OHIO[1]

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ABSTRACT. Of the 425 plant taxa observed within Schwamberger Preserve, 8 taxa (1.88%) are listed on Ohio's legal list of endangered species prepared by the Ohio Department of Natural Resources. Eight taxa (1.88%) are on the legal list of threatened species. The location of the 5 plant communities within the preserve is governed by variation of the depth of the water table rather than variation of soil pH. The future of Schwamberger Preserve, as a viable scientific study area, will be determined by management practices such as acquisition of a buffer zone, control of the aspen thickets, and maintenance of existing excavations and creation of one or two new excavations to serve as specific study sites.

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INTRODUCTION

Most of the original 338 km^2 tract of land known as the Oak Openings (Moseley 1928) consisted of wind-blown dunes interspersed with low wet areas. In these interdunal swales, where the water table often stood above the sand, the wet prairies (Sears 1926) came into being. Although agriculture, settlement, and urbanization have altered the vegetation, remnants of these wet prairies still exist. One of the better preserved wet areas is Schwamberger Preserve, 50 hectares of land located in Section 11, Spencer Township, northeast of the junction of Schwamberger Road and Old State Line Road, in western Lucas County, Ohio. Ten hectares of this property are now owned and administered by the Toledo Chapter, Ohio Nature Conservancy. The remainder is privately owned, including the Toledo Muzzleloaders Gun Club located along Schwamberger Road. The purposes of this study are (1) to record the vascular plant species growing within the preserve, with particular emphasis at this time on endangered and threatened taxa; (2) to define and describe the main vegetational communities and their substrate; and (3) to recommend a schedule of future action needed to maintain this wet-mesic prairie remnant (Curtis 1959) as a viable scientific preserve.

MATERIALS AND METHODS

The study site was visited once per week from April through October for 3 consecutive years, 1977, 1978 (Easterly 1979), and 1979 (Powell 1980). Additional observations have been made since 1979, especially of the endangered and threatened taxa. Vegetational communities were visually distinguished on the basis of dominant plants. Boundaries of the unwooded communities were paced off and mapped. Boundaries of the wooded areas were determined with the help of aerial photographs used in Ohio soil surveys (Stone and Powell 1977, Stone et al. 1980).

Voucher specimens were prepared for all vascular plant species and deposited in the herbarium at Bowling Green State University (BGSU). Frequency of occurrence notations follow Moseley's Flora of the Oak Openings (Easterly 1979). Nomenclature follows that used in Weishaupt (1971), Voss (1972), and Bentz and Cooperrider (1978).

The Ohio Division of Lands and Soils photomap No. 14 for Lucas County was used to compare the locations of soil types with the map of vegetational communities (Stone and Powell 1977). Seven soil-sampling locations were selected, including representatives from each soil type and from each vegetational community (table 1). Soil sampling was done in early July and again in late August of 1979. From each of the 7 locations, 3 samples were taken with a 2.54-cm diameter soil auger from the A, B, and C horizons. A distinct uniform color change was considered to indicate the change to the next lower

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TABLE 1

Vegetational Communities	Soil Type	Depth to Water Table: Early July	Depth to Water Table: Late August	Horizon	Sampling Depth	pH
Oak woods	Spinks	below 25 cm	110 cm	A	8–10 cm	4.9
				B	Below 10 cm (+)	4.9
				C	60 cm	5.0
Wet meadow	Granby	50 cm	60 cm	A	10–35 cm	5.0
				B	35–85 cm	5.2
				C	85 cm	5.2
Forb meadow	Tedrow	70 cm	80 cm	A	10–26 cm	5.1
				B	26–125 cm	5.2
				C	125 cm	5.2
Dry prairie	Tedrow	70 cm	86 cm	A	10 cm	5.1
				B	Below 12 cm (+)	5.1
				C	125 cm	5.1
Thicket-woods transition	Oakville	60 cm	96 cm	A	10–26 cm	5.0
				B	26–62 cm	5.2
				C	Below 62 cm (+)	5.2
Aspen thicket	Ottokee	46 cm	56 cm	A	10–30 cm	5.6
				B	30–120 cm	5.9
				C	Below 120 cm (+)	7.3
Sand pit edge	Oakville	35 cm	50 cm	A*	surface	5.3
				B*	12–50 cm	5.4

*Upper soil levels have been removed by excavation.
(+)Measurements or samples taken 3–5 centimeters below recorded figure.

horizon. The organic portion of the A horizon, which would affect the determination of the pH values, was discarded.

Whenever the water table was encountered during the July sampling, its depth from the surface was noted (table 1). Depths of the water table were again recorded in August. The pH values recorded in table 1 represent the mean value of several readings made at each location and in each horizon. The values were measured with a Cornell pH Test Kit in the field and again in the laboratory after the soil samples had been dried. The pH test kits are prepared by the Department of Agronomy, Cornell University, Ithaca, NY 14850.

RESULTS

The parent materials of the soils in Schwamberger Preserve are lacustrine and aeolian sands. Differences in the soils are primarily accounted for by topographic variations which affect the depth of the water table. The sand at the study site may be 7.6 — 12 m thick over a layer of glacial till that varies from 4.6 to 12 m thick (Forsyth 1968). Dry, sterile soils (Ottokee, Oakville, and Spinks fine sands) are on the tops of the well-drained knolls, while the humus-rich soils (Granby loamy fine sand and Tedrow fine sand) are in the moist to wet swales. The Tedrow fine sand is on slight inclines, but is somewhat poorly drained (fig. 1). The Granby soil is in the wet areas and is known as "black sand" (Stone and Powell 1977, Stone et al. 1980).

Soil pH values (table 1) were fairly uniform throughout the study areas, ranging from 4.9 to 5.3 for surface soils to a depth of 35 cm, and from 5.0 to 5.4 from 50 cm to 125 cm depths (table 1). Only in one place did this range differ significantly; here the surface reading was 5.6 and the 125-cm reading was 7.3. The sand may be thinner at this site, causing the sub-surface water to contact the limey clayey till.

The wet meadow (wet-mesic prairie) of Schwamberger Preserve, with its adjacent wooded areas, occupies approximately 50 ha. Five plant communities are located within this area: (1) the prairie, (2) oak forest, (3) aspen thickets, (4) sphagnum moss remnants, on which *Bartonia* is found, and

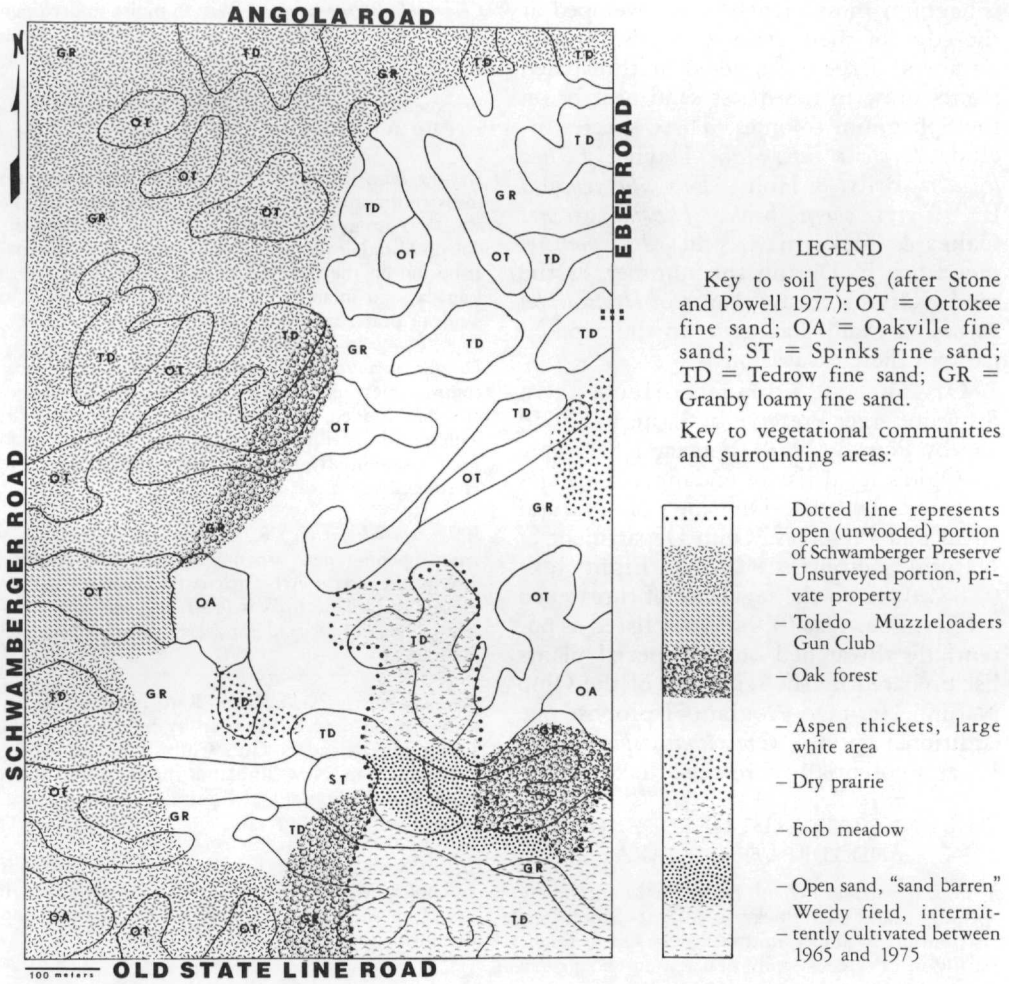

FIGURE 1. Schwamberger Preserve and adjacent wooded areas. Section 11, Spencer Township, Lucas County, NW Ohio.

(5) disturbed or weedy habitats. The definition of the dry open sand areas follows the concepts proposed in the Vegetation of Wisconsin (Curtis 1959). Moist to wet prairies may be referred to as "forb meadows," (Anderson 1971). Much of the open sand area at the south end of the preserve along Old State Line Road has been cultivated. After cultivation ceased (Campbell 1946), this portion reverted to dry prairie. Much of the soil in the northern portion of the open areas is water-saturated in late winter and during the spring; standing water usually is not present.

At 2 locations in Schwamberger Preserve, the sandy soil has been recently excavated (1976) and deposited in large mounds. The Toledo Muzzleloaders Gun Club (fig. 1) bulldozed the sand to form backstops for its firing range. The other site, located at the dead end of Eber Road, was bulldozed for possible home construction (1975). Water collects at both locations durings the spring. Large numbers of

sphagnum moss plants have developed at the edge of these excavations. Surprising numbers of the endangered or threatened plants grow in the moist sand near or on the Sphagnum colonies. These species include *Drosera intermedia* Hayne, *Lechea leggettii* Britt. & Holl., *Polygala cruciata* L., *Xyris torta* Sm., *Juncus greenei* Oakes & Tuckerm., and *Lycopodium inundatum* L. During the summer, as the sand is drying, many plants of *Hemicarpha micrantha* (Vahl) Pax grow in the exposed parts of these excavations.

Of the 425 taxa collected in Schwamberger Preserve by Easterly (1979) and by Powell (1980), 8 taxa (1.88%) are on Ohio's legal list of endangered species prepared by the Division of Natural Areas and Preserves, Ohio Department of Natural Resources (1982). Eight taxa (1.88%) are on the legal list of threatened species. Four taxa (0.94%) are listed as potentially threatened on the special plants list prepared by the scientists of the Ohio Natural Heritage Program. I propose one additional species, *Convolvulus spithamaeus* L., as a potentially threatened taxon.

THE ANNOTATED LIST OF ENDANGERED AND THREATENED TAXA

Agalinis skinneriana (Wood) Britt. Rare in dry sandy opening near aspen thickets; August–September; distribution in upper midwest near Great Lakes, usually in calcareous sandy prairies; an endangered species in Ohio; synonym: *Gerardia skinneriana* Wood, nomenclature (Bentz and Cooperrider 1978).

Aureolaria pedicularia (L.) Raf. var. *ambigens* (Fern.) Farw. Rare in dry sand on sand ridge near aspen thickets; August–September; distribution in upper midwest near Great Lakes, usually in sterile sandy soils; an endangered variety in Ohio; synonym: *Gerardia pedicularia* L., nomenclature (Bentz and Cooperrider 1978).

Bartonia virginica (L.) BSP. Rare on sphagnum moss patches located here and there at edge of intermittent ponds and along paths in the wet meadow; August–September; distribution in northeastern USA, southern Canada, to Wisconsin and south to Florida and Alabama, originally from the Atlantic coastal plain (Parker 1936), habitat usually associated with Polytrichum or Sphagnum moss; a potentially threatened species on the Ohio Heritage list.

Convolvulus spithamaeus L. Rare in moist to dry open sand (Oakville fine sand) near oak forest; June; northern distribution from New England to Iowa, usually on sandy or rocky soils, or on shale barrens; proposed by Easterly to be added to the Ohio Heritage list as threatened.

Drosera intermedia Hayne. Rare in the sphagnum moss community, but sometimes abundant on the wet sand around the intermittent pond next to the Toledo Muzzleloaders Gun Club; July–August; distribution on the Atlantic coastal plain to southern Canada, and inland to Minnesota, usually on acid sands or peats; an endangered species in Ohio.

Drosera rotundifolia L. Rare in sphagnum moss communities, less frequent than the preceding species and hidden in aspen thickets; July–August; widespread distribution in Canada and USA in acid soils; a potentially threatened species on the Ohio Heritage list.

Habenaria ciliaris (L.) R. Br. Rare in moist to dry sandy opening near aspen thickets; July–August; distribution on the Atlantic coastal plain to southern Canada and inland to Wisconsin and Missouri, usually in bogs or in acid sands; a threatened species in Ohio.

Helianthemum bicknellii Fern. Rare in moist to dry sands behind sand hill created by bulldozer for the Toledo Muzzleloaders Gun Club; June–July; distribution from New England through the upper midwest to Nebraska and Kansas; a threatened species in Ohio.

Helianthemum canadense (L.) Michx. Rare in dry sands on knolls; May–June; widespread distribution in New England, mid-Atlantic states to Iowa and Missouri; a threatened species in Ohio.

Hemicarpha micrantha (Vahl) Pax. Generally rare throughout the Oak Openings, but sometimes abundant on the wet sands of excavations at Schwamberger Preserve; August–September; an Atlantic coastal plain species that has spread throughout most of USA and Mexico on moist to wet sands along ponds and streams; a threatened species in Ohio.

Hieracium canadense Michx. var. *fasciculatum* (Pursh) Fern. Rare in moist to wet sand at edge of intermittent pond next to the Toledo Muzzleloaders Gun Club; July–August; distribution along the St. Lawrence River, through the lower Great Lakes region, to Iowa, usually in sandy or rocky openings; an endangered taxon in Ohio.

Juncus greenei Oakes and Tuckerm. Rare in moist to dry sand near knolls behind the Toledo Muzzleloaders Gun Club; June–July; distribution

from Newfoundland southwest through the Great Lakes region to Minnesota, originally from the Atlantic coastal plain; a threatened species in Ohio.

Krigia virginica (L.) Willd. Rare in dry sandy soil (Oakville fine sand) near oak forest; July–August; widespread distribution throughout eastern USA, usually on disturbed dry sandy soils; a threatened species in Ohio.

Lechea leggettii Britt. and Holl. var. *moniliformis* (Bickn.) Hodgdon. Rare in moist to wet sand of excavation behind sand hill created for Toledo Muzzleloaders Gun Club; June–July; a coastal plain species that has become isolated in northwestern Indiana and northern Ohio (Hodgdon 1938); a threatened taxon in Ohio.

Liatris squarrosa (L.) Michx. Rare in dry sand near knolls behind Toledo Muzzleloaders Gun Club; July–August; a southern species that has spread northward and westward mostly on argillaceous soils; a threatened species in Ohio.

Lilium philadelphicum L. var. *andinum* (Nutt.) Ker. Rare in moist to dry sand in clearing next to aspen thickets; July; distribution from Montreal southwestward through the plains to New Mexico, usually in prairies or sandy openings; a potentially threatened taxon on the Ohio Heritage list.

Lycopodium inundatum L. Rare in the sphagnum moss communities and in wet sand at edge of intermittent ponds; June–July; extensive distribution in Canada and northern USA; a potentially threatened species on the Ohio Heritage list.

Polygala cruciata L. var. *aquilonia* Fern. and Schub. Rare in the moist to wet meadow that serves as a shooting range for Toledo Muzzleloaders Gun Club and at the edge of intermittent pond nearby; July–August; distribution mostly on southern coastal plain with inland extension through the Great Lakes region to Minnesota; an endangered taxon in Ohio.

Sisyrinchium atlanticum Bicknell. Rare in the moist meadow at the shooting range and in wet meadow owned by the Toledo Chapter, Ohio Nature Conservancy; May–June; distribution mostly on the Atlantic coastal plain with inland extension to the Great Lakes region (Parker 1936); an endangered species in Ohio.

Viola lanceolata L. Generally rare in the Oak openings but sometimes common in the wet meadow of Schwamberger Preserve; May–June; general distribution throughout eastern USA, but best developed on the Atlantic coastal plain; an endangered species in Ohio.

Xyris torta Sm. Generally rare in the Oak Openings but sometimes abundant in the wet sands of intermittent pond adjacent to shooting range of Toledo Muzzleloaders Gun Club; July–August; general distribution along the Atlantic coastal plain with inland extensions through the Great Lakes region to Missouri, Iowa, and southern Wisconsin; an endangered species in Ohio, nomenclature (Voss 1972).

DISCUSSION

Management practices within our natural areas, planned or unplanned, play the most important role in determining the fate of threatened or endangered species. Certain events at Schwamberger Preserve, although unintentional as far as benefit is concerned, clearly demonstrate the need to understand the growth habits of endangered species. If a suitable habitat is present, the species flourishes. In the wet sand depressions made by bulldozers creating sand hills for back stops at the Toledo Muzzleloaders Gun Club, excellent habitats were created for such genera as *Xyris, Hemicarpha, Drosera, and Lechea*. Hundreds of plants were growing in these habitats during the summer and fall of 1979 and 1980. Powell (1980) suggested more such excavations be made and used as a management technique to maintain Schwamberger Preserve as a viable and useful scientific study site.

In his "Flora of the Oak Openings," Moseley (1928) quoted from a letter from Edgar T. Wherry, USDA chemist at the time, concerning the pH of soils within the Oak Openings. Wherry stated that the soil pH at the crest of sandy ledges was mostly acid, while pH readings in ditches and low, moist places were slightly alkaline, thus accounting for the unusual assemblage of plant species throughout the sand areas. Our studies of Schwamberger Preserve (Powell 1980) and other areas (Easterly 1979) would agree with the unusual assemblage of plants but not with the soil pH observations (table 1). A fairly consistent range of acidic pH readings was recorded in all study sites. No readings were recorded from 6.0 to 7.0. Only one reading was above 7.0, this at a depth of 125 cm. Both

Powell (1980) and Moseley (1928) concluded that variation in the depth of the water table is more important in determining the location of plant species. The depth of the limey glacial till, (Forsyth 1968), usually is too great to account for much variation in soil pH values.

To maintain Schwamberger Preserve as a viable scientific study area and as a refuge for threatened and endangered species, the following action is recommended: (1) acquisition of land to serve as a buffer zone around the preserve; (2) control of the aspen thicket expansion by complete removal, by selective cutting, or by controlled burning; and (3) continued cooperation with members of the Toledo Muzzleloaders Gun Club to maintain existing excavations and to construct one or 2 new excavations to serve as study sites.

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